

DIFFERENTIAL DIAGNOSIS OF CLOSTRIDIAL MYONECROSIS

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INTRODUCTION

IN RECENT YEARS the diagnosis of clostridial disease has been enhanced by the advent of commercial fluorescent-antibody and better culture methods for *Clostridium chauvoei*, *C. septicum* and *C. novyi*. Evolving from this new rapid method, new diagnostic considerations have emerged.

LITERATURE REVIEW

For many years, most diagnosticians have regarded demonstrations of *C. chauvoei* in dead tissues as solid evidence of ante-mortem infection; but in recent years, Kerry (8) demonstrated *C. chauvoei* in the livers and spleens of 20% of healthy cattle. The tissues were removed from fifty two-year-old consecutively slaughtered cattle immediately after death, and their findings corroborate with Cobb and McKay's (4) report of finding *C. chauvoei* in the liver of healthy older dogs. In addition to the finding of *C. chauvoei* in tissues of healthy animals, there are reports of *C. chauvoei* in surprisingly diverse materials, such as a day old piglet (20), a variety of diseased canine tissues (13), mink kits (9), an injured horse (17) and decomposed whales (3).

The isolation of *C. septicum* is generally viewed with caution if not skepticism, when the source material is bovine tissue, especially if lesions associated with *C. chauvoei* were present in the necropsied carcass. Newson (11) cultured the spleens of 200 sheep dead from pneumonia, bloat, "emaciation" and dysentery and recovered *C. septicum* from 28, *C. perfringens* from five and *C. novyi* from one. He acknowledged a primary *C. septicum* syndrome but cautioned against accepting *C. septicum* isolation without evaluation. Patrizi and Patrizi (14) demonstrated that clostridia, including *C. septicum*, were present in the carcasses of well-fed slaughter cattle within several hours after

death. Nilakantan and Dhanda (12) reported that *C. septicum* could be cultured from guinea pig carcasses dead from *C. chauvoei*, if left for a day or more at 18–20°C and an atmospheric humidity of 83%. At 72 hours, these carcasses acquired *C. perfringens*. They concluded that *C. chauvoei* was the sole cause of blackleg even though 9% of 179 spontaneous blackleg cases yielded *C. septicum* only and 5% *C. perfringens* only by culture.

Even the classical bradsot (braxy) of sheep caused by *C. septicum* is being challenged regarding its primary clostridial etiology (6). However, there are authors who assign a primary role to *C. septicum* as a sole cause of some cases of blackleg. Prevot and Enescu (15) describe such a case in a heifer. Vawter (21) describes cases which cause him to state that *C. septicum* blackleg "eventually may be regarded as a spontaneous cattle disease." Smith and Bone (18) suggest that *C. septicum* may be a primary disease in cattle.

CASE HISTORY

The premise was in irrigated Gallatin Valley in southern Montana where nearly all cattle are routinely vaccinated against *C. chauvoei* and *C. septicum*. Three days after a three-year-old registered Hereford calved, she was observed to limp slightly and also to have a retained placenta. On the following morning, she was found prostrated with massive crepitant swelling over the heavy muscles of the proximal portion of the right pelvic limb. At the same time, circulating blood had a non-protein nitrogen value of 54 mg% (of which only 21 mg% was blood urea nitrogen), a blood leukocyte count of 2500/cmm, an inverted calcium-phosphorous ratio (8 mg% serum calcium and 8.4 mg% serum inorganic phosphate), some hemocentration (hematocrit of 45% and hemoglobin value of 16.1 g%), a rectal temperature of 100.9°F, injected conjunctivae, and an expiratory grunt. At this time, jugular vein blood cultures yielded a pure population of *C. septicum*. The attending veterinarians believed that therapeutic endeavors were not justified and the heifer died in the afternoon of the same day, approximately twenty-four hours after the first observed evidence of lameness. The dead animal

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TABLE I
DISTRIBUTION OF BACTERIA ISOLATED FROM TISSUES

	<i>C. septicum</i>	<i>C. novyi</i>	<i>C. perfringens</i>	<i>E. coli</i>	Beta Hem. <i>Streptococcus</i>
Post-mortem blood	+	—	—	—	—
Necrotic heart muscle	+	—	—	—	—
Cerebrum	+	—	—	—	—
Liver	+	—	—	—	—
Spleen	+	—	—	—	—
Kidney	+	+	—	—	—
Lung	+	—	—	—	+
Uterine lumen exudate	+	+	+	+	—

remained outside at winter temperature for three hours prior to necropsy. In addition to the expected findings of acute metritis, plump septicemic spleen, widespread serosal ecchymoses, and generalized serohemorrhagic lymphadenitis, the liver was already in the foamy state due to the endogenous gas of clostridial fermentation. Most striking, however, was the solid charcoal black color of the porous necrotic skeletal musculature. Although this quite certainly was a case of puerperal sepsis, the primary muscle lesion appeared to be in heavy muscles of the right rear limb. There were black gaseous lesser lesions, presumably metastatic, in the brachiocephalicus, serratus ventralis cervicalis, diaphragm, latissimus dorsi, psoas, the masseters, myocardium and the tongue. Histopathology revealed no unexpected findings except that the numerous bacilli present were somewhat more elongated than expected in typical *C. chauvoei* in tissue sections. Extended aerobic and anaerobic cultures were prepared both in plates and into chopped meat broth for subsequent plating. All plating media contained 2% agar to prevent spreading by *C. septicum* colonies.

Results of this extended and repeated culturing gave the results shown in Table I.

It should be pointed out that while culture of necrotic (striated) heart muscle yielded *C. septicum* only, cultures of necrotic (striated) skeletal muscle were not prepared. However, in previous experiences, ante-mortem blood cultures from both spontaneous and experimental *C. chauvoei* infections produced *C. chauvoei* and never *C. septicum* in the limited animals studied (2).

DISCUSSION

The rapidity with which the liver of a gas gangrene case becomes spongy from bacillary gas production is often surprising; it would appear that the excellent nutriment and energy stores in liver tissue provide abundant quality substrate, and the central body location of this

organ delays temperature loss as the carcass cools, thus prolonging bacterial fermentation.

The extensive muscle lesions in the above described animal were similar to those of *C. chauvoei* infection and reflect the striking similarity between the two organisms. There is, however, a fairly common belief that when blackleg lesions yield *C. septicum*, the blackleg case is due to non-isolated, no longer demonstrable *C. chauvoei* and that the isolated *C. septicum* is a secondary invader. With demonstration (8) that normal cattle harbor *C. chauvoei*, just as they do other clostridial species, the fact becomes evident that cadaverous invasions by *C. chauvoei* are likewise possible. With the advent of fluorescent antibody techniques, diagnosis no longer depended on culturally separating the less hardy *C. chauvoei* from *C. septicum* and the possibility of better eliminating monoclostridial myonecrosis due to *C. septicum* appeared. However, *C. septicum* blackleg cases found pure on the basis of fluorescent antibody technique continue and furthermore, it has been our observation that *C. novyi* appears to proliferate much more frequently and vigorously in decomposed bovine tissues than does *C. septicum*. In many clostridial epizootics, some individuals appear to die from *C. chauvoei*, some from *C. septicum* and some from a combination of them. Sterne and Edwards (19) report porcine deaths on a premise where two of the pigs died of *C. chauvoei* infection and the other two died of *C. septicum* infection. From two sheep cultured in a blackleg epizootic, Prudentor and Zhdanor (16) reported one dying from *C. chauvoei* and one from *C. septicum*. Contini (5) reports 44 cases of blackleg of which 24 were pure *C. chauvoei* infections, sixteen were pure *C. septicum* infections and four were dual infections. In veterinary diagnostic work (Montana and Minnesota), the authors have repeatedly received specimens from blackleg epizootics where clostridial myonecrotic problems on a given premise did not appear to be monoclostridial.

The similarity of the antigenic constitution of the two organisms has been pointed out by Weinberg *et al* (22), Moussa (10), Katitch (7) and Al-Khatib (1) who contend that the two organisms should be in a common species. Certain strains that are *C. chauvoei* on the bases of chemical tests are *C. septicum* on the basis of known antigenic constitution and hemolysins. With their conclusions, it is quite certain that the separation of the two organisms is not as distinct as previously considered and that the use of combined *C. chauvoei*-*C. septicum* bacterin is well-founded.

SUMMARY

Clostridial myonecrosis in livestock is often a plural infection, with two or more species of genus *Clostridium* participating. *C. septicum* appears to be capable of producing a primary syndrome and lesion pattern strikingly similar to those caused by *C. chauvoei*.

RÉSUMÉ

La nécrose musculaire des bestiaux consécutive à une infection par des clostridies résulte souvent d'une infection multiple, en ce sens qu'elle implique deux espèces ou plus du genre *Clostridium*. *Cl. septicum* semble capable de provoquer un syndrome primaire et des lésions d'une similarité frappante à ce qu'on observe lors d'infections à *Cl. chauvoei*.

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